I-8 CORRIDOR PROFILE STUDY

ARIZONA / CALIFORNIA STATE LINE TO JUNCTION I-10

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Draft Working Paper 3: Corridor Performance Goals and Objectives

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LIST OF ABBREVIATIONS

Abbreviation	Name	Abbreviation	Name
ADOT	Arizona Department of Transportation	SCMPO	Sun Corridor Metropolitan Planning Organization
ADT	Average Daily Traffic	SENTRI	Secure Electronic Network for Travelers Rapid Inspection
BLM	Bureau of Land Management	SHSP	Strategic Highway Safety Plan
CAG	Central Arizona Governments	SOV	Single Occupancy Vehicle
DMS	Dynamic Message Signs	SR	State Route
FY	Fiscal Year	TAC	Technical Advisory Committee
F+I	Fatal and Incapacitating	TI	Traffic Interchange
HPMS	Highway Performance Monitoring System	TTI	Travel Time Index
1	Interstate	TPTI	Truck Planning Time Index
LCCA	Life Cycle Cost Analysis	TTTI	Truck Travel Time Index
LPOE	Land Port of Entry	U.S.	United States
LRTP	Long Range Transportation Plan	V/C	Volume to Capacity
MP	Milepost	YCAT	Yuma County Intergovernmental Public Transportation Authority
MPD	Multimodal Planning Division	YMPO	Yuma Metropolitan Planning Organization
P2P	Planning to Programming Linkages		
PDI	Pavement Distress Index		
PSR	Pavement Serviceability Rating		
PTI	Planning Time Index		



1.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) has identified eleven corridors considered essential in defining the overall health of the statewide transportation system, and is conducting a series of Corridor Profile Studies to plan for their desired performance. These Corridor Profile Studies will link the statewide plan, *What Moves You Arizona*, and the *Planning to Programming Linkage (P2P)*, which are part of a framework designed to integrate the planning and programming processes in a transparent, defensible, logical, and reproducible way.

The eleven corridors are being evaluated within three separate groupings.

The first three studies (Round 1) began in spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: I-10 to Mexico International Border
- I-40: California State Line to I-17

The second round (**Round 2**) of studies, initiated in spring 2015, include:

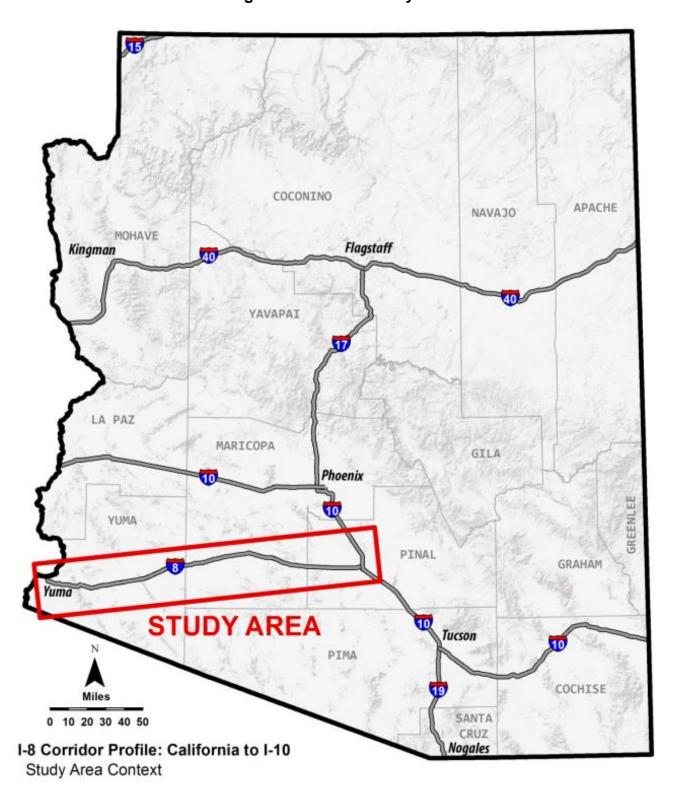
- I-8: California State Line to I-10
- I-40: I-17 to New Mexico State Line
- SR 95: I-8 to I-40

The third round (**Round 3**) of studies, to be initiated in November 2015 include:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 93/US 60: Nevada State Line to SR 303L

Interstate 8 (I-8), depicted in **Figure 1**, is one of the strategic statewide corridors identified and the subject of this Corridor Profile Study (**Round 2**).

Figure 1: Corridor Study Area





1.1 Corridor Study Purpose

The purpose of the I-8 Corridor Profile Study is to define a comprehensive corridor planning and programming approach to help make system appropriate decisions. This is achieved by measuring corridor performance and using the findings to inform improvement solutions. Lifecycle cost analysis (LCCA) and risk assessment are applied in developing corridor recommendations. This Corridor Profile Study, along with similar studies from Rounds 1, 2 and 3, will define a process to:

- Inventory past improvement recommendations
- Define goals and objectives for the future of the corridor
- Assess existing performance based on quantifiable performance measures
- Propose various solution sets to improve corridor performance in light of the vision
- Identify projects that provide quantifiable benefit relative to performance
- Prioritize the projects for future implementation.

1.2 Corridor Study Goals and Objectives

The primary objective of this study is to identify a recommended set of potential projects for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The I-8 Corridor Profile Study will define solution sets and improvements for I-8 that can be evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance. Corridor benefits will be categorized by the following three investment types:

- Preservation: Activities that protect transportation infrastructure by sustaining asset condition or extend asset service life.
- Modernization: Highway improvements that emphasize upgrading efficiency, functionality, and safety over adding capacity.
- Expansion: Improvements that add transportation capacity through the addition of new facilities and or services.

This study will identify potential actions to ensure the performance of the I-8 corridor is maintained at acceptable levels. Proposed actions will be compared based on their risk to achieving desired performance levels, life-cycle costs, and cost-benefits to produce a prioritized list of projects that help achieve corridor goals. The following goals have been identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Match solutions with deficiencies in measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

1.3 Working Paper 3 Overview

The purpose of Working Paper 3 is to establish the performance goals, objectives and emphasis areas for the I-8 corridor. The framework is based upon the five performance areas used to characterize the health of the I-8 corridor: pavement, bridge, mobility, safety, and freight. The product of Working Paper 3 is the development of performance goals and objectives for I-8 against which baseline performance can be evaluated. Differences between baseline performance and performance goals and objectives provide the framework for defining corridor needs in the investment areas of preservation, modernization, and expansion.

1.4 I-8 Corridor Overview

A national east-west transportation corridor, I-8 spans between San Diego, California and Casa Grande, Arizona. In Arizona, I-8 originates at the Colorado River in the City of Yuma and extends approximately 178 miles east to Casa Grande at the junction with I-10. Traveling east beyond Yuma, the corridor continues through Yuma County and the Town of Wellton, passes through Gila Bend in Maricopa County and terminates at I-10 southeast of Casa Grande in Pinal County. Much of the I-8 corridor is rural and undeveloped.

The entire length of the Arizona segment of I-8 is the subject of this Corridor Profile Study. Viewed as more than a highway, the corridor is a multimodal facility that moves people and freight and connects communities. The corridor serves a variety of uses, from supporting freight movement, to transporting produce from the "lettuce capital of the US" near Yuma, to accessing tourism/recreation centers west in San Diego to serving the growing Sun Corridor in central Arizona.

1.5 Study Location and Corridor Segments

The study limits extend from milepost (MP) 0 at the California State Line to MP 178.33 at the interchange with I-10 in Casa Grande. Identification of highway segments was based on roadway, traffic and jurisdictional characteristics to allow for the appropriate level of analysis for similar operating environments. Nine segments have been identified for this corridor, one segment is considered an urban environment and the remaining eight are considered rural environments. **Table 1** and the Corridor Map, shown in **Figure 2** depict these segments.



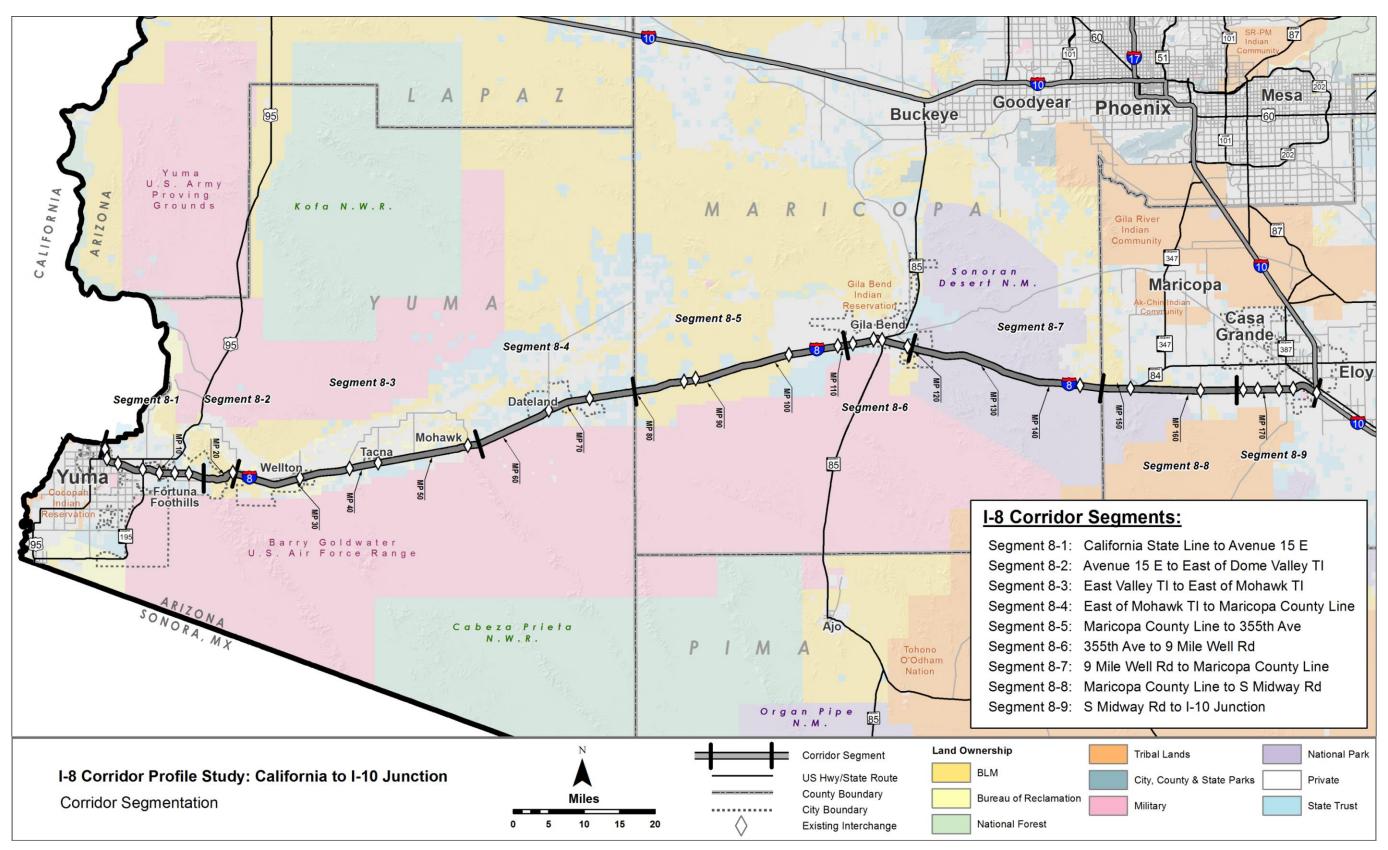


Table 1: I-8 Corridor Segments

Segment	Begin	End	Begin MP	End MP	Length (mi)	Thru Lanes (EB,WB) WB)	ADT (2013)	Character Description
8-1	California State Line	Avenue 15 E	0.0	16.3	16.30	2, 2	20,500 - 41,200	This segment starts at the California Border, traversing the urban area of Yuma and including 7 TIs for access. Within the limits, I-8 was constructed on new alignment away from old US 80, now Business 8 (B-8). At Avenue 9E, I-8 returns to the old US 80 alignment utilizing parallel frontage roads. Avenue15E serves as the Yuma city limit, with significant changes in terrain, level of development and traffic volumes.
8-2	Avenue 15 E	East of Dome Valley TI	16.3	21.4	5.05	2, 2	12,700 – 14,900	I-8 crosses through the mountainous terrain of Telegraph Pass, utilizing the old US 80 alignment. The US Border Patrol Station is also located in this section. One TI is located within Segment 2.
8-3	East of Dome Valley TI	East of Mohawk TI	21.4	56.5	35.08	2, 2	9.600 – 12,700	I-8 was constructed on a new alignment within this rural segment. Four TIs provide access to the local communities. The terrain is uniform except for the easternmost mile where Mohawk Pass allows a small mountain range to be crossed. There is little fluctuation in traffic numbers across this segment.
8-4	East of Mohawk TI	Maricopa County Line	56.5	79.6	23.36	2, 2	9,700 – 10,200	This segment is considered a rural operating environment and terminates at the Yuma County/Maricopa County line, which is also the break point between the Yuma Metropolitan Planning Organization (YMPO) and Maricopa Association of Governments (MAG). Beginning at the Mohawk TI, I-8 utilizes old US 80 as the eastbound roadway. Additionally, the county line has generally been used as a project limit. Two TIs are inclusive.
8-5	Maricopa County Line	355 th Avenue	79.6	110.4	30.53	2, 2	12,900 – 16,600	This segment starts at the county line and ends at approximately the western limits of Gila Bend. This segment is differentiated by jurisdiction rather than any changes in terrain or traffic. Four TIs provide local access.
8-6	355 th Avenue	9 Mile Well Road	110.4	120	9.62	2, 2	5,700 – 12,900	I-8 crosses the Gila Bend area between East and West TIs with a total of 4 TIs serving the area. The mainline roadway is on new alignment. Traffic numbers in this segment increase due to the B-8 and SR 85 junctions.
8-7	9 Mile Well Road	Maricopa County Line	120	147.6	27.60	2, 2	5,100 – 5,700	This segment runs from east Gila Bend to the Maricopa / Pinal County Line. One TI falls within the limits of Segment 7.
8-8	Maricopa County Line	S Midway Road	147.6	166.5	19.00	2, 2	5,100 – 5,300	This segment is defined by jurisdiction. Midway Road is assumed to be the western limits of Casa Grande development. The jurisdictional boundary between MAG and the Sun Corridor Metropolitan Planning Organization (SCMPO) occurs within this segment at approximately MP 160. Two TIs provide local access.
8-9	S Midway Road	Interstate 10	166.5	178	11.75	2, 2	5,500 – 9,500	This segment is defined as entering into the greater Casa Grande area. This segment terminates at the junction with I-10 and includes 5 Tls.



Figure 2: I-8 Corridor Study Segmentation





2.0 CORRIDOR FUNCTIONALITY

The I-8 corridor provides movement for significant freight and recreation needs within Arizona. It serves intrastate, interstate and international commerce linking the agriculturally rich Yuma

area with California to the west and all points east. I-8 is a key link in the regional, statewide and national freight network, collecting and distributing goods between Mexico, west coast and ports throughout the United States (U.S.). Because of its location and orientation, it also serves as a major connection to recreational opportunities in Western Arizona and Southern California.



2.1 National Context

I-8 is part of the National Highway System, traversing 345 miles between Casa Grande, Arizona and San Diego, California. It is designated as a national intercity truck route and hazardous material route, as well as being considered a Key Commerce Corridor within Arizona by connecting west coast ports with Gulf coast ports and eastern markets. This route provides a more direct connection between I-10 east of Casa Grande and San Diego than following I-10 to Los Angeles. Within Southern California, I-8 provides connectivity with access to I-5 and I-15, the Port of San Diego and the local military bases. It also runs parallel to the Barry M. Goldwater Range, the nation's third largest military reservation. The Range covers approximately 1.7 million acres and is primarily used flight training.

2.2 Regional Connectivity

I-8 connects to US 95 and SR 195 in the Yuma area, SR 85 in Gila Bend, SR 84 just south of Maricopa which then connects to SR 347, and I-10 in Casa Grande. This connectivity provides regional access to major freight generators in southern and central Arizona with southern California and Mexico. Regional access is also provided for recreational opportunities along the Colorado River and in Southern California.



2.3 Truck Traffic

I-8 serves as a trade route for agricultural products grown in Yuma and the Gila River Valley, as well as for other statewide commerce needs, by providing access to west coast ports, Gulf Coast ports, and eastern markets. A concentration of major agricultural facilities is located in the Yuma area between Avenue 3E and Araby Road. Major distribution centers, such as Walmart, are also located in the Casa Grande area. The high volume of truck traffic on Avenue 3E and Araby Road creates congestion on the southern legs of these intersections. According to ADOT's HPMS Location Report for 2014, the average daily commercial truck volumes along the corridor range from 1,100 – 5,400, with the higher frequencies closer to Yuma. One reason for the higher volume of commercial trucks near Yuma is due to the proximity to the San Luis Border Crossing. In addition, the Union Pacific Railroad (UPRR) also runs parallel to I-8 for much of the corridor, providing a major freight connection. Potential freight switching opportunities exist in both the Yuma and Casa Grande areas, providing an interface between rail freight, truck freight and distribution centers.

The San Luis Border Crossing is located less than 25 miles south of Yuma via US 95. In 2014, this crossing was the third busiest in Arizona in terms of total number of loaded truck containers, accounting for approximately 8% of all truck crossings within the State. The San Luis Border Crossing was also the second busiest crossing for personal vehicles and total pedestrians, which accounted for 36% of all personal vehicle crossings (Bureau of Transportation Statistics, 2015). The San Luis Land Port of Entry (LPOE) serves US 95, I-8, SR 195 and Mexico Federal Highway 2. The LPOE consists of two facilities. The primary check point includes six general lanes and two SENTRI Lanes. A second 80-acre commercial vehicle check point was recently constructed 5-miles east of the original port of entry and is designed to process 150 trucks per day with the potential to expand to 650 trucks by 2030. Five other border crossings between California and Arizona are also accessible from I-8. Due to its location near the U.S. and Mexico Border, I-8 has a significant impact on the national and regional scale.

One permanent border checkpoint is located just east of Avenue 15E. Another checkpoint that is occasionally used is located just west of the Yuma/Maricopa county line. Both locations require all vehicles to stop for inspection, which can create some delay with commercial truck traffic.

One weigh-in-motion station is located on I-8 just east of the California State Line. The weigh-in-motion station allows for commercial truck traffic to utilize the scales but reduces delays. There are also four weigh-in-motion traffic counters installed along the interstate corridor.



2.4 Commuter Traffic

Commuter traffic on I-8 occurs mostly within the urbanized areas of Yuma and Casa Grande, which are the primary economic centers along the corridor. According to the most recent traffic volume data maintained by ADOT, traffic volumes range from approximately 28,000 vehicles per day in the Yuma area to approximately 7,000 vehicles per day in the Casa Grande area. Within the Yuma area, the commuter traffic generally occurs between downtown Yuma and Fortuna Foothills, which lies entirely within Segment 1 of this Corridor Profile Study.

According to the 2013 American Community Survey data from the US Census Bureau, 77% of the workforce in the Yuma region relies on a private vehicle to get to work, 82% of the workforce in the Gila Bend region relies on a private vehicle to get to work, and 80% of the workforce in the Casa Grande region relies on a private vehicle to get to work. The average commute travel time for commuters from small rural communities along I-8, such as Wellton, is 20-25 minutes. The smaller communities along I-8 have a high percentage of workers commuting to larger cities, such as Yuma or Casa Grande.

Additionally, there is a significant amount of military related uses in the Yuma region, with the Barry M. Goldwater Air Force Range Complex and the Marine Corps Air Station in the vicinity.

2.5 Recreation and Tourism

I-8 provides access to recreational opportunities along the Colorado River and in Southern California. Many recreational users travel I-8 to access the sand dunes just west of Yuma and the Colorado River in several areas along US/SR 95. This creates a mix of vehicles types on I-8 as many recreational vehicles with trailers use the route.

The Sonoran Desert National Monument is also located in the I-8 corridor between Gila Bend and Casa Grande. Motorists utilize I-8 to access SR 85 when traveling south to Organ Pipe National Monument and the border crossing with Mexico at Lukeville, which provides access to the Mexican port city of Puerto Peñasco.

2.6 Multimodal Uses

2.6.1 Transit and Rail Services

The largest regional public transportation service provider along the I-8 corridor is the Yuma County Intergovernmental Public Transportation Authority (YCAT). YCAT services nine fixed routes, a vanpool open to any commuter group in the county, an on-call demand services for individuals living with a disability and a nighttime shuttle specifically serving colleges in the area. YCAT services connect Yuma to San Luis in the south and to the Town of Welton to the west via I-8. YCAT also provides connections to and from the Greyhound stops in Yuma.

Greyhound operates two stops in Yuma, one along Castle Done Avenue at the Yuma Palms Regional Center and the other just east at 14th Avenue. These stops service Greyhound Route 580, El Paso to Los Angeles. The route has additional stops in Gila Bend and Casa Grande.

Amtrak operates one platform from Yuma. The Sunset Limited Route travels between Louisiana and California, with three trains departing weekly. The Texas Eagle Route, which runs from Chicago to San Antonio, can also be accessed from the Sunset Limited Route.

2.6.2 Air Transportation

Municipal airports along the corridor are located in Eloy and Gila Bend, with a larger airport located in Yuma just south of I-8. The predominant use of the Eloy Airfield is for skydiving and regional crop dusting. The Gila Bend Airport has no permanently located aircraft and approximately ten operations per day. The Yuma International Airport is used for military aviation, commercial travel, and medical transport, as well as for general aviation purposes. The Yuma International Airport is currently served by one commercial airline, U.S. Airways/American Airlines, and provides up to six round-trip daily flights between Yuma and Phoenix Sky Harbor (PHX).

2.6.3 Non-Motorized Transportation

Bicycles are permitted to use the shoulders along I-8, which are generally 10-foot, although there are several bridges where the width is less than 4-foot. Pedestrians are prohibited on the entire route.

2.7 Traveler Amenities

Within the I-8 corridor, ADOT operates two rest areas, a truck parking area and a roadside table. The Ligurta Truck Parking area is located just east of the Mohawk Mountains, which is the mountainous terrain with steep grade between Yuma and Wellton. The Sentinal Rest Area serves both westbound and eastbound directions, located between MP 83 and 84. The Mohawk Rest Area, at MP 56, and the Table Top Roadside Tables just east of Casa Grande are currently closed. Design for the rehabilitation of Mohawk Rest Area began in Fiscal Year (FY) 2014 and it is planned for construction in FY 2016.

Dynamic Message Signs (DMS) are installed along I-8 just east of the California State Line, in the Fortuna Foothills, just east of Gila Bend, and just west of the interchange with I-10.

2.8 Land Ownership, Land Uses and Jurisdictions

As shown in **Figure 2**, I-8 crosses multiple jurisdictions and land holdings throughout Yuma, Maricopa and Pinal Counties. A majority of the land west of Gila Bend is a checkerboard of private and State Trust land, with some Bureau of Land Management (BLM) ownership. East of



Gila Bend the corridor is predominantly National Park land until just west of Casa Grande, where it again traverses a checkerboard of private and State Trust Land. In the vicinity of the corridor, but not immediately adjacent to I-8, there are significant military and tribal lands. Much of the military, tribal and national parks lands are open space. It is common for these areas to be utilized by drug traffickers and smugglers, which can cause abrupt crossings of I-8 at unmarked locations.

2.8.1 Population Centers

The major population centers within the I-8 corridor are centered around the urbanized areas of Yuma and Casa Grande. **Table 2** provides a summary of the U.S. Census population for the communities along I-8. The urbanized area of Yuma is experiencing growth trending to the east, along the I-8 corridor, with increases in the Fortuna Foothills area and beyond into the Wellton region. The community of Gila Bend is at a major transportation junction and has plans for significant growth, although the population is currently low. Casa Grande serves as a major transportation hub at the junction of I-10 and I-8, and is an important center to Pinal County. It is currently experiencing significant growth in both population and employment opportunities, particularly focused in commercial and industrial development.

Table 2: Population on the I-8 Corridor

Community	2010 Population	2014 Population	Projected 2040 Population
Yuma County	195,751	210,500	333,943
Yuma	93,064	96,327	144,302
Fortuna Foothills	26,265	27,407	36,393
Wellton	2,882	3,067	5,479
Tacna	602	610	649
Maricopa County	3,817,117	3,990,011	6,174,940
Gila Bend	1,900	2,000	14,500
Pinal County	376,369	403,526	934,939
Casa Grande	48,664	51,329	106,668
Eloy	16,657	19,245	72,206

Source: U.S. Census, Arizona Department of Administration – Employment and Population Statistics

2.8.2 Major Traffic Generators

Within the Yuma and Casa Grande areas, major traffic generators are related to freight, including agricultural and industrial traffic, as well as some military related traffic in the Yuma area. Outside of the study area, major traffic generators are the southern California ports and the San Luis Border Crossing, which generate significant freight traffic that utilizes I-8. Additionally, recreational opportunities along the Colorado River, both near Yuma and further north to Parker, generate recreational related traffic on I-8.

2.9 Wildlife Linkages

The Arizona State Wildlife Action Plan (SWAP) provides a 10-year vision for the entire state, identifying wildlife and habitats in need of conservation, insight regarding the stressors to those resources, and suggestive actions that can be taken to alleviate those stressors. Using the Habimap Tool that creates an interactive database of the information included in the SWAP, the following wildlife considerations were identified in relation to the I-8 corridor:

- Wildlife waters exist to the north and south of I-8 between SR 84 and Gila Bend.
- I-8 travels through allotments/pastures from just east of SR 84 to Gila Bend, and periodically from west of Gila Bend to east of Dateland. This roughly corresponds to the area controlled by the Bureau of Land Management.
- Some State Land holdings are present, primarily from just east of Gila Bend to Wellton.
- Arizona Wildlife Linkages potential linkage zones exist along I-8 between MP 39 and MP 100 (Linkage No. 72), as well as crossing I-8 in the vicinity of MP 8 MP 9 (Linkage No. 70). Habitat fracture zones are identified from the California border to MP 18 (with the exception of MP 8 MP 9), MP 21 to MP 39, MP 100 to MP 120 and MP 150 to I-10.
- Species and Habitat Conservation Guide indicates sensitive habitats in the vicinity of South Maricopa Mountains Wilderness, just north of I-8 to the east of Gila Bend, and along the Gila River in the vicinity of Wellton and Tacna.
- Species of greatest conservation need are identified in the vicinity of SR 84 and the Sonoran Desert National Monument.
- A moderate level of species of economic and recreational importance are identified along
 I-8 to the north from Casa Grande to the riparian area west of Gila Bend.



2.10 Transportation Assets

Corridor transportation assets are summarized in Figure 3. The majority of assets are located along the more densely populated portions of the corridor through Yuma and Casa Grande areas. There are two ports of entry, two weigh-in-motion scales and two transit/rail stations in Yuma, all of which are assets not provided elsewhere along the corridor. Additionally, near the eastern section of the corridor, beginning around MP 160 and continuing to I-10, is one DMS, five grade-separated crossroads and five existing interchanges. This area has a higher concentration of grade-separated crossroads and existing interchanges than any other along the corridor.

The portion of the corridor between Yuma/Fortuna Foothills and MP 160 is generally more rural and the existing assets are predominately grade-separated crossroads and existing interchanges. This stretch of corridor, which is roughly 140 miles, includes two open rest areas, two Border Patrol check points, one permanent traffic counter and one DMS. There is also a pavement test section along the eastbound and westbound lanes between MP 88 and MP 92.5.

2.11 Conclusion of Corridor Characteristics

I-8 is one of the two primary transportation routes connecting Southern California to Arizona. Although the interstate is less than 200 miles in length within the state, there are many significant variables that influence its existing and future condition. The Transportation Assets Map (**Figure 3**) shows key features that are available to the travelling public today.

While some public transportation services are offered within the region, these services either don't span the entire corridor or are only operated on a limited basis. Furthermore, projected population growth in Yuma and Pinal County and more specifically within City of Yuma and Casa Grande will continue to strain the existing infrastructure. Additionally, freight traffic at the San Luis Border Crossing is forecast to grow considerably within the near future, ultimately impacting traffic and economic conditions along the interstate corridor.



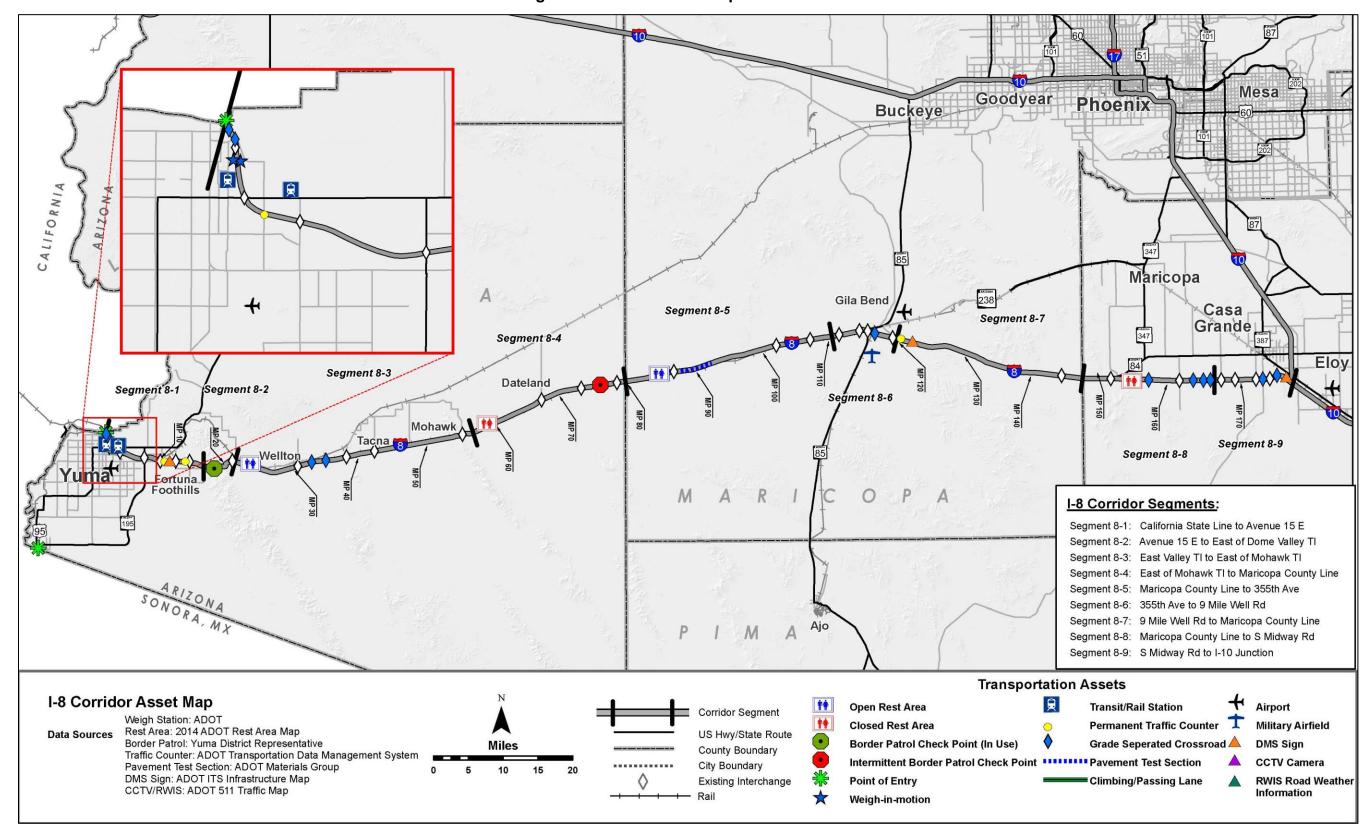


Figure 3: I-8 Corridor Transportation Assets



3.0 SUMMARY OF CORRIDOR BY PERFORMANCE AREA

A system to establish baseline corridor performance was developed through a collaborative process with ADOT, the Technical Advisory Committee (TAC) and the Corridor Teams for the profile studies. Baseline performance was evaluated using primary and secondary performance measures to define the corridor health and identify locations warranting further analysis to define needs. Corridor needs constitute the difference in baseline corridor performance compared to performance objectives.

The performance system consists of five areas: Pavement, Bridge, Mobility, Safety, and Freight. For each of these performance areas, a primary measure – known as the Index – was defined along with a set of secondary measures that allows for a more detailed analysis of corridor performance. **Table 3** lists the primary and secondary measures that were evaluated for each of the five performance areas.

Working Paper 2 evaluated the overall corridor performance (as a weighted average by segment length) and individual segment performance in the five aforementioned areas. The primary and secondary performance measures were quantified where feasible. A scale for each measure was developed based on adopted ADOT thresholds, where applicable, or on statistical analysis of statewide datasets. The scaling is split into three levels, each of which is represented by a corresponding color. The scale levels are named "good" (green), "fair" (yellow), and "poor" (red), except that for measures based on a comparison to statewide averages (e.g., the Safety performance area) where the levels are called "above average" (green), "average" (yellow), and "below average" (red). Some of the secondary measures are "hot spots" that cannot be readily quantified at a segment or overall corridor level, so no scaling was developed for "hot spots".

Good / Above Average Performance
Fair / Average Performance
Poor / Below Average Performance

The corridor weighted average ratings are summarized in **Figure 4**, which also provides a brief description of each performance measure. **Figure 5** shows the corridor and segment performance for each primary measure. The following sub-sections summarize the measured performance in each performance area according to the analysis findings documented in Working Paper 2.

Table 3: Corridor Performance Measures

Performance Area	Primary Measures	Secondary Measures		
Pavement	Pavement Index - based on combination of International Roughness Index and Cracking	Directional Pavement ServiceabilityPavement Area FailurePavement Hot Spots		
Bridge	Bridge Index - based on Deck Rating, Substructure Rating, or Superstructure Rating	 Bridge Sufficiency Rating Functionally Obsolete Lowest Bridge Rating Bridge Hot Spots 		
Mobility	Mobility Index - based on combination of Current V/C and Future V/C	 Existing Directional Peak Hour Volume/Capacity Future Volume/Capacity Directional Travel Time Index (TTI) Directional Planning Time Index (PTI) Road Closure Frequency Percent Non-SOV Trips Bicycle Accommodation 		
Safety	Safety Index - based on frequency of fatal and incapacitating injury crashes	 Percent Strategic Highway Safety Plan Emphasis Areas Crash Unit Types Directional Safety Index Safety Hot Spots 		
Freight	Freight Index - based on Truck Planning Time Index	 Directional Truck Travel Time Index (TTTI) Directional Truck Planning Time Index (TPTI) Road Closure Duration Clearance Restrictions 		



3.1 Pavement

Approximately 173 of the 178 miles on I-8 rated as "Good" or "Fair" for the overall Pavement Index, which is comprised of the primary measures PSR (roughness rating) and PDI (cracking rating). Segment 8-2 traversing through the Telegraph Pass was the exception with a "Poor" performance. Due to the significant area of pavement cracking, 4 of the 9 segments rated poorly for percentage of area in failure. The westbound direction exhibits more cracking than the eastbound direction.



3.2 Bridge

Every segment on I-8 fell within the "Fair" performance rating for the Bridge Index, which consisted of the deck, substructure, superstructure and structural ratings. A total of 115 bridges were included in the evaluation. Two bridges rated as structurally deficient. At MP 0.01, the Colorado River Viaduct (Eastbound) has a deck rating of 4. At MP 172.55, the Thornton Road TI Underpass has substructure and structural evaluation ratings of 4. In addition, eleven bridges have multiple ratings of 5 for the deck, substructure, superstructure and structural evaluation. Five of the nine analysis segments on I-8 exceeded the threshold for "Poor" performance as percentage of Functionally Obsolete Bridges by current ADOT design standards. These include Segments 8-3 (40.8%), 8-4 (100.0%), 8-5 (58.5%), 8-6 (43.8%) and 8-9 (44.4%).



3.3 Mobility

The I-8 corridor rated in the "Good" threshold of the Primary Mobility Index. Two operating environments were utilized for evaluating Mobility. These include Urban 4 Lane Freeway and Rural 4 Lane Freeway < 25,000 ADT. Both the current and future capacity is considered "Good". Segment 8-1 within the Yuma urban area has higher mobility index of all the I-8 segments. The future traffic volumes on I-8 in Segments 8-8 and 8-9 are expected to double with an annual growth rate of more than four percent but still under the capacity of the corridor. Other secondary measures with "fair" or "poor" performance on some corridor segments included directional PTI, % non-SOV trips, and bicycle accommodation.

3.4 Safety

The Safety Index of all I-8 segments rated "Good/Above Average" performance when compared to the statewide average within similar operating environments, in terms of fatal and incapacitating injury (F+I) crashes. The safety performance evaluation also utilized the two operating environments for analysis. The entire corridor has less than the statewide average for number of F+I crashes. Examining a five-year time period, fatal crashes equaled 2 and incapacitating injury crashes equaled 7 in the urban area. In the rural area, there were 20 fatal crashes and 68 incapacitating injury crashes. These resulted in averages less than half of the statewide averages.

Of the F+I crashes that occurred on I-8 during 2010-2014, no concentrations of crashes were observed. However, Segments 8-3 and 8-9 rated the lowest in terms of the amount of F+I crashes caused by the top five emphasis areas of the *Strategic Highway Safety Plan* (SHSP).

3.5 Freight

The performance of freight mobility is overall "Good" within the I-8 corridor, with Segment 8-1 in the Yuma metropolitan area as the only exception, which fell within the "Fair" scoring threshold. All I-8 segments scored within the "Good" range in terms of Directional Truck Travel Time Index, meaning that there is little difference between observed truck free flow speeds and peak period truck speeds. This pattern exists in both the eastbound and westbound directions. All eastbound and westbound segments rated within the "Good" threshold for the Directional Truck Planning Time Index, with the exception of Segment 8-1. This indicated that there is some level of moderate recurring delay In the Yuma area. Closure duration and frequency in Segment 8-2 were identified as "Poor" performance. In addition, several locations with truck height restrictions exist along I-8, with most of the restrictions concentrated in the eastern portion of the corridor near Casa Grande. Among the height restrictions, there are two locations in Segment 8-2 and Segment 8-7 where trucks are not able to ramp around the restriction.



Figure 4: I-8 Corridor Performance Index Summary



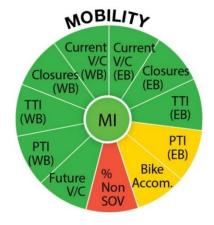
Pavement Index (PI): based on two pavement condition ratings from the ADOT Pavement Database. The two ratings are the International Roughness Index (IRI) and the Cracking Rating. The calculation of the Pavement Index uses a combination of these two ratings.

- » Directional Pavement Serviceability the weighted average (based on number of lanes) rating which measures the condition of the pavement in each direction of travel.
- » % Pavement Failure the percentage of pavement area that is rated above the failure thresholds for IRI or Cracking, as established by ADOT Materials Group (IRI > 105 or Cracking > 15)



Bridge Index (BI): based on four bridge condition ratings from the ADOT Bridge Database. The four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating.

- Sufficiency indicative of bridge sufficiency to remain in service. The factors that contribute to the Sufficiency Rating include structural adequacy and safety, serviceability and functional obsolescence, and essentiality for public use.
- % Functionally Obsolete indicative of the percentage of deck area on bridges that is no longer functionally adequate for its current use, such as a lack of shoulders or the inability to handle current traffic volumes. Functionally Obsolete does not directly relate to the structural adequacy.
- Bridge Rating identifies the lowest bridge rating on each segment.



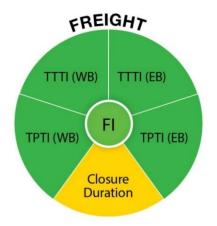
Mobility Index (MI): an average of the current volume-to-capacity (V/C) ratio and the projected 2035 bi-directional frequency and rate of fatal and V/C ratio.

- » Current V/C the existing peak hour V/C ratio in both directions of the corridor. This measure provides an understanding of the directional operating characteristics of the corridor during the existing peak hour from a mobility and congestion stand-
- Future V/C a measurement of the future 2035 V/C ratio that identifies how the corridor will operate in the future from a mobility and congestion stand-
- » Directional Closures the average number of times a given location in the corridor was closed per mile in a specific direction of travel per year.
- » Travel Time Index (TTI) the ratio of the average peak period travel time to the free-flow travel time. The TTI represents recurring delay along the
- Directional Planning Time Index (PTI) the ratio of total travel time needed for 95 percent on-time arrival to free-flow travel time. The PTI represents non-recurring delay along the corridor.
- % Non-single Occupancy Vehicle Trips (Non-**SOV)** - represents the percentage of trips that are taken by vehicles carrying more than one occupant.
- Bicycle Accommodation represents the percentage of roadway that is accommodating for bicycle travel.



Safety Index (SI): combines the incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona.

- % SHSP Emphasis Area the percentage of fatal and incapacitating crashes that involve at least one of the five Strategic Highway Safety Plan (SHSP) Emphasis Areas.
- % Truck Crashes the percentage of fatal and incapacitating crashes that involve a truck.



Freight Index (FI): a reliability performance measure based on the bi-directional planning time index for truck travel.

- Directional Truck Planning Time Index **(TPTI)** - the ratio of total travel time (for trucks only) needed for 95 percent on-time arrival to free-flow travel time. The TTPI represents non-recurring delay along the corridor.
- **Directional Truck Travel Time Index** (TTTI) - the ratio of the average peak period travel time (for trucks only) to the free-flow travel time. The TTTI represents recurring delay that occurs along the corridor.
- Closure Duration the average time a given location in the corridor was closed per mile per year.

I-8 Corridor Performance Study (all performance measures are weighted averages for all segments of the corridor)

GOOD

POOR

I-8 Corridor Profile Study



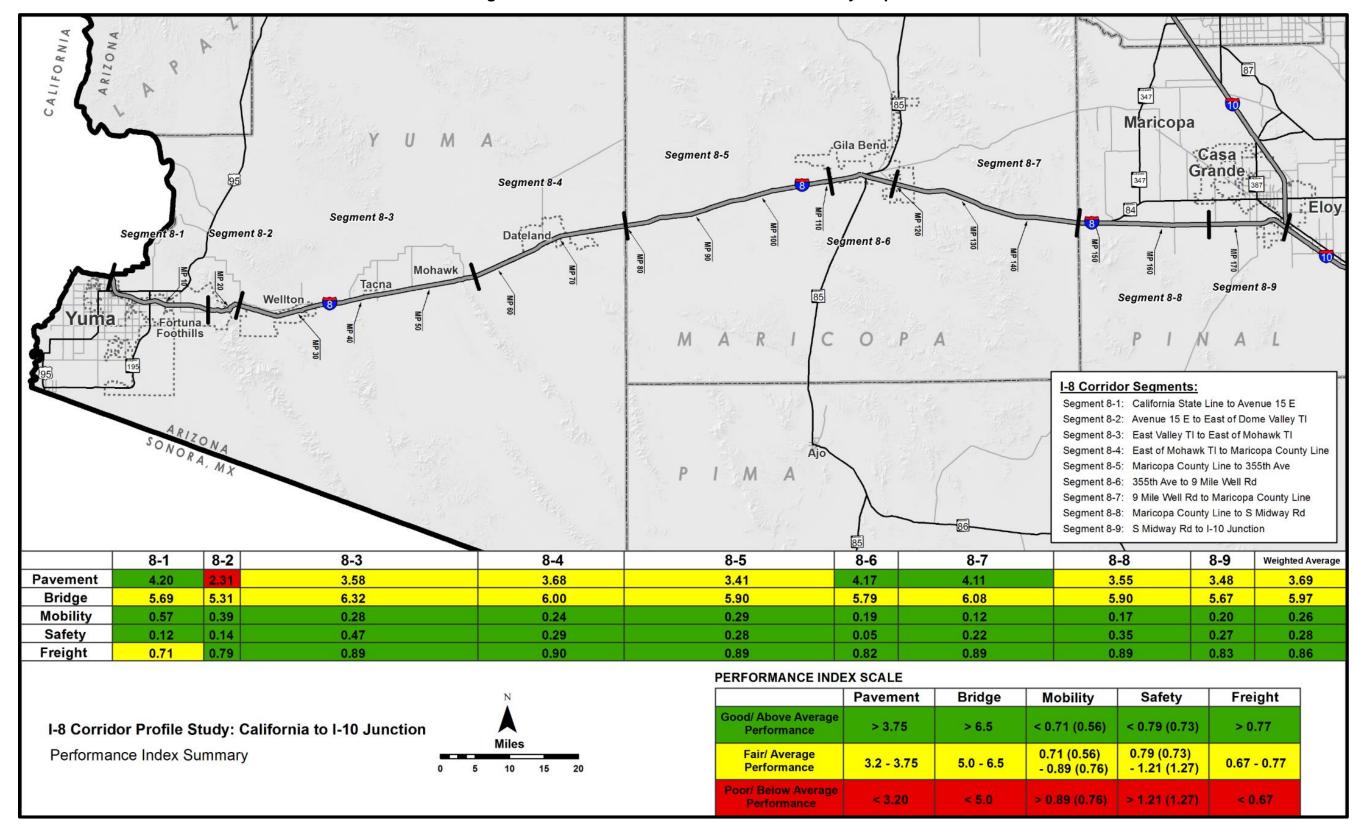


Figure 5: I-8 Corridor Performance Index Summary Map



4.0 CORRIDOR PERFORMANCE GOALS AND OBJECTIVES

I-8 is a major transportation corridor for commerce and tourism. ADOT has designated I-8 as a Key Commerce Corridor and as part of the National Primary Freight Network. Based on discussions with the primary stakeholders within the corridor, the performance goals for the I-8 corridor include:

- Support goals identified in Long-Range Transportation Plan
- Preserve and modernize highway infrastructure
- Maintain highway security within the right-of way
- Improve mobility and connectivity
- Provide a safe and reliable route for recreation and tourist travel to/from Mexico,
 Southern California and Southern Arizona destinations
- Provide a safe, reliable and efficient freight route between Arizona, California and Mexico
- Provide safe, reliable and efficient connection to all communities along the corridor to permit efficient regional travel

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035, *What Moves You Arizona* through an extensive outreach program. The statewide goals relevant to the I-8 performance framework areas have been identified as part of Working Paper 3 efforts and coordinated with the corridor goals formulated for the five performance areas. **Table 4** shows the aligned statewide and I-8 goals.

Specific objectives have been developed for the I-8 corridor to meet these performance goals, as detailed below:

- Improve pavement ride quality
- Maintain structural integrity of bridges
- Reduce current and future congestion in the Yuma and Casa Grande areas
- Reduce delays from non-recurring events and incidents to improve reliability
- Reduce fatal and serious injury crashes
- Reduce delays and restrictions to freight movement to improve reliability
- Improve travel time reliability (including impacts on motorists due to freight traffic)

4.1 Stakeholder Meetings

The corridor team met with stakeholders at two separate meetings, one at the Southwest District and one at the Southcentral District, to discuss the I-8 performance evaluation results in Working Paper 2 and to develop the performance goals and objectives for the corridor. A summary of these meetings related to the performance goals, objectives and emphasis areas is provided in the subsequent section. Information provided on the I-8 performance evaluation was documented in Section 5.0 of Working Paper 2.

Southwest District Meeting: Held on September 28, 2015 and included participants from the ADOT Southwest District, ADOT Multimodal Planning Division, the Yuma Metropolitan Planning Organization (YMPO), and the consultant team.

Southcentral District Meeting: Held on October 1, 2015 and included participants from the ADOT Southcentral District, ADOT Multimodal Planning Division, the Sun Corridor Metropolitan Planning Organization (SCMPO), the Central Arizona Governments (CAG), the City of Tucson, and the consultant team.

The attendees contributed to the development of goals and objectives as listed in Section 4.0 and provided the following insight.

- Most critical to the corridor is maintaining mobility for all motorists, including freight
- Preserving and modernizing infrastructure is viewed as the predominant future need
- Based on recommendations from other studies performed on I-8, consideration for increased laneage should be included as part of the study development
- Recent funding shortfalls have resulted in minimal or no improvement to mainline shoulders. Moving forward, it is desirable to consider pavement condition of shoulders for safety and multimodal purposes.
- Since this corridor operates with "good" mobility ratings, it is an ideal corridor for testing new technology
- It is important to minimize incident closures. In addition to delay costs to motorists and freight industry, alternative route signs are temporary and must be placed at time of incident.
- Considering the corridor serves high freight movement, infrastructure like traffic interchanges and rest areas need to be modernized to better accommodate trucks
- Ongoing discussions continue with regard to potential increase in weight limits for truck loads. If the limits are raised, the pavement needs would be impacted.
- Consider improved pavement ride quality as it relates to safety
- Mobility, Freight, and Safety are focus performance areas



4.2 Performance Emphasis Areas

Based on agency input, the performance of Mobility, Safety and Freight were identified as "emphasis areas" for the I-8 corridor. These three emphasis areas will warrant more attention and focus than the other performance areas on the I-8 corridor. Subsequently, the corridor-wide weighted average performance objectives for Mobility, Safety, and Freight are identified with a higher standard than the corridor-wide weighted average performance objectives for other performance areas.

4.3 Performance Objectives

Considering the corridor performance goals and identified "emphasis areas", performance objectives were developed. The objectives are to be measured using the primary and secondary measurements for each performance area, with the aim of achieving a desired level of performance. The desired performance is based on scale levels for the overall corridor and for each corridor segment.

The performance objectives for the five performance areas are shown in **Table 4**. The colors shown in **Table 4** represent the corresponding level of performance as described earlier, with green indicating "good" or "above average" performance and yellow indicating "fair" or "average" performance. Good or above average performance is the desired performance objective for the corridor weighted average of each primary measure for performance areas designated as "emphasis areas". Fair or average performance is the desired objective for all segments in all performance areas and for the corridor weighted average for performance areas that are not emphasis areas.



Table 4: Corridor Performance Goals and Objectives

ADOT Statewide	I-8 Corridor Goals	I-8 Corridor Objectives	Performance Area	Performance Measure	Performance Objective	
LRTP Goals					Corridor Average	Segment
	Improve mobility and	Deduce current and		Mobility Index	Good	Fair or Better
	connectivity	Reduce current and	Mobility (Emphasis Area)	Existing Directional Peak Hour V/C		Fair or Better
	Provide a safe and reliable route for	future congestion in the urbanized areas Reduce delays from non-recurring events and incidents to improve reliability		Future V/C		Fair or Better
				Closure Frequency		Fair or Better
	recreation and tourist			Travel Time Index		Fair or Better
	travel to/from Mexico,			Planning Time Index		Fair or Better
Improve Mobility	Southern California and Southern Arizona destinations			Percent Non-SOV Trips		Fair or Better
and Accessibility Support Economic Growth	Provide safe, reliable and efficient connection to all communities along the corridor to permit efficient regional travel	Improve bicycle accommodation		Percent Bicycle Accommodation		Fair or Better
	Provide a safe, reliable and efficient freight route between Arizona, California and Mexico	Reduce delays and		Freight Index	Good	Fair or Better
		restrictions to freight movement to improve reliability	Freight (Emphasis Area)	Travel Time Index		Fair or Better
		Improve travel time		Planning Time Index		Fair or Better
		reliability (including impacts to motorists due to freight traffic)		Closure Duration		Fair or Better
Preserve and				Bridge Index	Fair or Better	Fair or Better
Maintain the State		Maintain structural integrity of bridges	Bridge	Bridge Sufficiency Rating		Fair or Better
Transportation				Bridge Rating		Fair or Better
System	Preserve and modernize highway infrastructure	integrity of smages		Percent Deck Area on Functionally Obsolete Bridges		Average or Better
		Improve pavement ride	Pavement	Pavement Index	Fair or Better	Fair or Better
				Pavement Serviceability		Fair or Better
		quality		Percent Pavement Area Failure		Average or Better
Enhance Safety and	Maintain highway	Reduce fatal and serious	Safety (Emphasis Area)	Safety Index	Above Average	Average or Better
Security	security within the right-	injury crashes		Percent SHSP Emphasis Areas		Average or Better
	of way	injury ordones		Directional / Safety		Average or Better



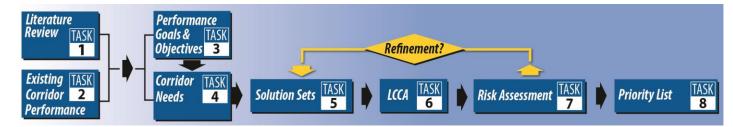
5.0 NEXT STEPS

The overall Corridor Profile Study process is shown in **Figure 6**. The process consists of eight tasks where the final results will provide candidate projects for P2P prioritization and inform the LRTP Update.

The next step in the I-8 Corridor Profile Study will be to conduct a needs assessment based on the relationship between the existing performance and the desired performance (Task 4). The corridor team will compare measured performance completed in Task 2 to the Corridor Objectives and Goals identified in this Working Paper 3 (Task 3). A "need" is identified when measured performance does not meet the expected performance objective.

The next deliverable, Working Paper 4, will report the findings from a needs analysis to help identify strategic improvements. The needs analysis will take a detailed look at the available data sets for each of the primary and secondary performance measures (including the "hot spots"). Following the needs assessment, "solution sets" will be developed to address the identified needs and improve performance (Task 5).

Figure 6: Corridor Profile Study Process



- Task 1 assesses work already completed in the corridor through a literature review
- Task 2 determines existing corridor performance based on data collected for the identified performance areas (pavement, bridge, mobility, safety and freight)
- Task 3 develops a long-term goals and objectives that define how the corridor can be expected to function, its primary purpose and performance emphasis areas
- Task 4 determines corridor needs by comparing existing conditions to expected performance
- Task 5 formulates solutions to raise performance levels throughout the corridor with a focus on high need areas
- Task 6 estimates the cost of solutions using life-cycle cost analysis (LCCA) and benefit cost analysis (BCA) approaches to ensure a full understanding of the long term costs to be managed
- **Task 7** performs a risk-based assessment to ensure that the solution set selected is the most effective at enhancing corridor performance. Where necessary, solution sets can be modified to maximize their performance contribution.
- Task 8 describes the strategic projects comprising the solution set using a Project Scoping Template